CLAIMS

What is claimed is:

1. A semiconductor device comprising:

a lateral high breakdown voltage MOSFET comprising

a drain diffused layer formed on a surface side of a semiconductor substrate,

a body diffused layer formed on the surface side of the semiconductor substrate surrounding the drain diffused layer,

a source diffused layer formed in the body diffused layer at a specified distance from a boundary of the drain diffused layer,

a drain contact diffused layer formed on a surface side of the drain diffused layer,

a gate oxide film formed at an end portion of the source diffused layer over a portion of the drain diffused layer;

a field oxide film formed on the surface of the drain diffused layer, in a region without the drain contact diffused layer and the gate oxide film, and

a gate electrode formed above the gate oxide film over a part of the field oxide film, wherein the gate oxide film comprises a thickness in which an electric field value of an absolute maximum rated voltage between a source and a drain is equal to or less than 4MV/cm, and a total amount of impurities in the drain diffused layer is equal to or more than $2\times10^{12}/cm^2$; and

a lateral low breakdown voltage MOSFET.

2. The lateral high breakdown voltage MOSFET as recited in claim 1, wherein the drain diffused layer, the source diffused layer, and the drain contact diffused layer are of a first conduction type and the body diffused layer and the semiconductor substrate are of a second conduction type.

3. The semiconductor device as recited in claim 1, wherein the lateral low breakdown voltage MOSFET is simultaneously formed in a diffused layer with the drain diffused layer.

4. The semiconductor device as recited in claim 1, wherein the lateral low breakdown voltage MOSFET is simultaneously formed in a diffused layer with the body diffused layer.

5. The semiconductor device as recited in claim 1, further comprising:

a first lateral low breakdown voltage MOSFET of a first conduction type simultaneously formed in a diffused layer with the body diffused layer; and

a second lateral low breakdown voltage MOSFET of a second conduction type simultaneously formed in the diffused layer with the drain diffused layer, where the first and second lateral low breakdown voltage MOSFETs form a CMOS circuit.

6. The lateral high breakdown voltage MOSFET as recited in claim 1, wherein a distance between the source diffused layer and the drain diffused layer is longer than a projected length of the drain diffused layer from the drain contact diffused layer.

7. The lateral high breakdown voltage MOSFET as recited in claim 1, wherein a length of the gate electrode on the field oxide film is equal to or less than 2mm.

8. The lateral high breakdown voltage MOSFET as recited in claim 1, wherein widths of depletion layers on an uppermost surface side of a semiconductor layer are W1 < W2 when a reverse bias voltage is applied between the source and the drain,

where W1 is a width of one of the depletion layers extending toward a side of the drain diffused layer, and

W2 is a width of another of the depletion layers extending toward a side of the body diffused layer.

9. A semiconductor device, comprising:

a lateral high breakdown voltage MOSFET comprising

a body diffused layer formed on a surface side of a semiconductor substrate,

a drain diffused layer formed on a surface side of the body diffused layer,

a source diffused layer formed in the body diffused layer at a specified distance from a boundary of the drain diffused layer,

a drain contact diffused layer formed on a surface side of the drain diffused layer,

a gate oxide film formed at an end portion of the source diffused layer over a portion of the drain diffused layer,

a field oxide film formed on the surface of the drain diffused layer, in a region without the drain contact diffused layer and the gate oxide film, and

a gate electrode formed above the gate oxide film over a part of the field oxide film, wherein the gate oxide film comprises a thickness in which an electric field value of an absolute maximum rated voltage between a source and a drain is equal to or less than 4MV/cm, and a total amount of impurities in the drain diffused layer is equal to or more than $2\times10^{12}/cm^2$; and

a lateral low breakdown voltage MOSFET.

10. The lateral high breakdown voltage MOSFET as recited in claim 9, wherein the drain diffused layer, the source diffused layer, and the drain contact diffused layer are of a first conduction type and the body diffused layer and the semiconductor substrate are of a second conduction type.

11. The semiconductor device as recited in claim 9, wherein the lateral low breakdown voltage MOSFET is simultaneously formed in a diffused layer with the body diffused layer.

12. The semiconductor device as recited in claim 9, wherein the lateral low breakdown voltage MOSFET is simultaneously formed in a diffused layer with the drain diffused layer.

13. The semiconductor device as recited in claim 9, further comprising:

a first lateral low breakdown voltage MOSFET of a first conduction type simultaneously formed in a diffused layer with the body diffused layer; and

a second lateral low breakdown voltage MOSFET of a second conduction type simultaneously formed in the diffused layer with the drain diffused layer, where the first and second lateral low breakdown voltage MOSFETs form a CMOS circuit.

14. The lateral high breakdown voltage MOSFET as recited in claim 9, wherein a distance between the source diffused layer and the drain diffused layer is longer than a projected length of the drain diffused layer from the drain contact diffused layer.

15. The lateral high breakdown voltage MOSFET as recited in claim 9, wherein a length of the gate electrode on the field oxide film is equal to or less than 2mm.

16. The lateral high breakdown voltage MOSFET as recited in claim 9, wherein widths of depletion layers on an uppermost surface side of a semiconductor layer are W1 < W2 when a reverse bias voltage is applied between the source and the drain,

where W1 is a width of one of the depletion layers extending toward a side of the drain diffused layer, and

W2 is a width of another of the depletion layers extending toward a side of the body diffused layer.

17. A semiconductor device, comprising:

a lateral high breakdown voltage MOSFET comprising

a buried layer formed in a region of a semiconductor substrate,

a drain diffused layer formed on a surface side on the buried layer,

a body diffused layer formed by diffusion on the surface side on the buried layer surrounding the drain diffused layer,

a source diffused layer formed in the body diffused layer at a specified distance from a boundary of the drain diffused layer,

a drain contact diffused layer formed on a surface side of the drain diffused layer,

a gate oxide film formed on a surface of the body diffused layer, from an end of the source diffused layer over a portion of the drain diffused layer,

a field oxide film formed on the surface of the drain diffused layer, in a region without the drain contact diffused layer and the gate oxide film, and

a gate electrode formed above the gate oxide film over a portion of the field oxide film, wherein the gate oxide film comprises a thickness in which an electric field value of an absolute maximum rated voltage between a source and a drain is equal to or less than 4MV/cm, and a total amount of impurities in the drain diffused layer is equal to or more than $2\times10^{12}/cm^2$; and

a lateral low breakdown voltage MOSFET.

18. The lateral high breakdown voltage MOSFET as recited in claim 17, wherein the drain diffused layer, the source diffused layer, and the drain contact diffused layer are of a first conduction type and the body diffused layer and the semiconductor substrate are of a second conduction type.

19. The semiconductor device as recited in claim 17, wherein the lateral low breakdown voltage MOSFET is simultaneously formed in a diffused layer with the drain diffused layer.

20. The semiconductor device as recited in claim 17, wherein the lateral low breakdown voltage MOSFET is simultaneously formed in a diffused layer with the body diffused layer.

21. The semiconductor device as recited in claim 17, further comprising:

a first lateral low breakdown voltage MOSFET of a first conduction type simultaneously formed in a diffused layer with the body diffused layer; and

a second lateral low breakdown voltage MOSFET of a second conduction type simultaneously formed in the diffused layer with the drain diffused layer, where the first and second lateral low breakdown voltage MOSFETs form a CMOS circuit.

22. The lateral high breakdown voltage MOSFET as recited in claim 17, wherein a distance between the source diffused layer and the drain diffused layer is longer than a projected length of the drain diffused layer from the drain contact diffused layer.

23. The lateral high breakdown voltage MOSFET as recited in claim 17, wherein a length of the gate electrode on the field oxide film is equal to or less than 2mm.

24. The lateral high breakdown voltage MOSFET as recited in claim 17, wherein widths of depletion layers on an uppermost surface side of a semiconductor layer are $W1 < W2$ when a reverse bias voltage is applied between the source and the drain,

where W1 is a width of one of the depletion layers extending toward a side of the drain diffused layer, and

W2 is a width of another of the depletion layers extending toward a side of the body diffused layer.

25. The lateral high breakdown voltage MOSFET as recited in claim 17, wherein the lateral high breakdown voltage MOSFET is a lateral low breakdown voltage MOSFET of a first conduction type and is simultaneously formed in a diffused layer with the body diffused layer of a second conduction type.

26. The lateral high breakdown voltage MOSFET as recited in claim 17, wherein a lateral low breakdown voltage MOSFET of a second conduction type is simultaneously formed in a diffused layer with the drain diffused layer of a first conduction type, a lateral low breakdown voltage MOSFET of the first conduction type is formed in a diffused layer simultaneously formed with the body diffused layer of the second conduction type, and the low breakdown voltage MOSFETs of the first and second conduction types form a CMOS circuit.